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DEPARTMENT
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Automatic Data Processing
Equipment Selection Office

Washington, D.C.
20376

SOFTWARE
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FEDERAL COBOL COMPILER
TESTING SERVICE

COMPILER VALIDATION
REQUEST INFORMATION

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15. Supplementary Notes

16. Abstracts

This document provides information regarding the Federal COBOL Standard and all of the Government regulations associated with it. It discusses the background of the Federal COBOL Compiler Testing Service which was set up by a memorandum of agreement between the National Bureau of Standards and the Department of Defense delegating the authority to validate all COBOL compilers brought into the Federal inventory. The report discusses both the 1968 (FIPS PUB 21) and 1974 (FIPS PUB 21-1) COBOL Standards, the Federal Property Management Regulations regarding the implementation of FIPS PUB 21-1 as a Federal Standard, and the requirement of COBOL compiler validation in the procurement process. It also contains a list of all software products produced by the Software Development Division in support of the FCCTS as well as the Validation Summary Reports produced as a result of discharging the responsibility delegated by the NBS-DOD agreement. Note that the FCCTS should be contacted to receive the latest information regarding software products and VSR.

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FEDERAL COBOL COMPILER TESTING SERVICE

Compiler Validation Request Information

The information contained in this packet is provided to make the requestor of validation services aware of the Federal COBOL Standard, the various levels of COBOL contained in the Federal COBOL Standard, the impact of the Federal Property Management Regulation pertaining to the use of COBOL and to COBOL compiler validations, and the process of validating COBOL compilers.

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THE FEDERAL COBOL COMPILER TESTING SERVICE

1. BACKGROUND

Introduction

The Federal COBOL Compiler Testing Service (FCCTS) is an activity of the Software Development Division of the Department of the Navy, Automatic Data Processing Equipment Selection Office (ADPESO).

Since July 1, 1972, all COBOL compilers brought into the Federal Government have to be identified as implementing one of the levels of the Federal COBOL Standard as defined in FIPS PUB 21 (COBOL 68). By June 1977 all COBOL compilers brought into the Federal Government will have to be identified as implementing one of the four levels of the revised Federal COBOL Standard as defined in FIPS PUB 21-1 (COBOL 74). In the interim period between December 1975 and June 1977 compilers based on COBOL 68 can be used if a COBOL 74 compiler is not available. The National Bureau of Standards (NBS), which has the responsibility for the development and maintenance of Federal ADP Standards, has delegated to the Department of Defense (DOD), and thereby to ADPESO, the responsibility for the operation of a Government-wide COBOL Compiler Testing Service. This responsibility is discharged by the FCCTS through the implementation and maintenance of COBOL Compiler Validation Systems (CCVS).

Development of the COBOL Compiler Validation System

The standardization of COBOL began on 15 January 1963. This was the first meeting of the American Standards Association Committee, X3.4.4, the Task Group for Processor Documentation and COBOL. The program of work for X3.4.4 included, "Write test problems to test specific features and combinations of features of COBOL. Checkout and run the test problems on various COBOL compilers." A working group (X3.4.4.2) was established for creating the "test problems" to be used for determining feature availability.

In April 1967, the Air Force issued a contract for a system to be designed and implemented which could be used in measuring a compiler against the standard. The Air Force COBOL Compiler Validation System was to create test programs and adapt them to a given system automatically by means of parameter cards.

In August of 1967, the Special Assistant to the Secretary of the Navy created a task group to encourage the use of COBOL throughout the Navy. Being aware of both the X3.4.4.2 and Air Force efforts (as well as the time required for completion), a short term project was established to determine the feasibility of validating COBOL compilers. After examining the information and test programs available at that time, the first set of routines was produced by the Navy Programming Languages Group under the direction of Captain Grace Hopper, USNR. In addition to the original X3.4.4.2 design parameters, the Navy added the capability of displaying for analysis the actual as well as the expected result when a test failed.

The preliminary version of the Navy COBOL audit routines consisted of 12 programs, or about 5,000 lines of source code. The tailoring of the programs to a particular compiler or operating system was done by hand.

This was a rudimentary effort, but it provided evidence that the project was feasible, and suggested techniques for developing audit systems. Because of the favorable comments received on this initial work, the Navy decided to continue the effort.

After steady development and testing for a year, Version 4 of the Navy COBOL Audit Routines was released in December 1969. The routines consisted of 55 programs (18,000 card images) capable of testing the full standard. The routines had also become one of the benchmarks for all systems procured by the Department of the Navy in order to insure that the compiler delivered with the system supported the required level of American National Standard COBOL.

The Central COBOL Compiler Testing Facility

In December 1970, the Deputy Comptroller for Data Automation in the Office of the Secretary of Defense asked the Navy to create the DOD Compiler Validation System for COBOL, taking advantage of: (1) the better features of both the Navy COBOL Audit Routines (Version 4) and the Air Force CCVS; and (2) the four years of in-house experience in designing and implementing audit routines on various systems as well as the actual validation of compilers for procurement purposes.

Responsibility for insuring the appropriate validation of COBOL compilers throughout the Department of Defense was given to the Department of the Navy's Information Systems Division (Op-91), and the Central COBOL Compiler Testing Facility was created to discharge this responsibility.

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The Federal COBOL Compiler Testing Service

Under an agreement signed on April 16, 1973, between the Institute for Computer Sciences and Technology of NBS and DOD, NBS has delegated to DOD the authority to develop and maintain a COBOL Compiler Validation System (CCVS). The Navy ADP Equipment Selection Office (ADPESO) has been assigned the responsibility, and will perform cost-reimbursable test services using the CCVS. NBS will through the Federal COBOL Interpretation Committee (FCIC) resolve issues related to the interpretation of the Federal COBOL Standard.

The Federal COBOL Compiler Testing Service is an organization which provides a centralized, comprehensive means to determine whether a compiler has correctly implemented the possible expressions and functions that are defined for COBOL by the Federal Information Processing Standard Publication (FIPS PUB 21 - COBOL 68) adopted in July 1972 and its successor FIPS PUB 21-1 (COBOL 74) adopted in December 1975. Testing is also pertinent to the American National Standard COBOL (X3.23-1968) and American National Standard Programming Language COBOL (X3.23-1974), since they are the basis of the Federal COBOL Standard and its predecessor.

The Federal COBOL Compiler Testing Service provides a major tool to Federal data processing administrators for achieving substantially greater compatibility and interchangeability among COBOL programs and automated information systems. As a centralized service, it reduces costs and duplication in validation testing by individual agencies. In performing a rigorous audit of standards conformance, it contributes to lower program conversion costs in transition from one computer to another, shortens programmer retraining, and eases the burden of program documentation.

More important perhaps, for the benefit of all computer users and vendors, is the introduction of a uniform, substantive methodology of quality assurance in the software field. From this starting point may grow standardized quality tests for other software components and more meaningful standards in the computer industry.

2. PURPOSE AND NATURE OF COMPILER VALIDATION

The validation of a compiler will determine the degree to which a compiler conforms to the Standard language specifications on which it is based. The use of compilers that have attained a high degree of conformance with their respective language standards enhances program interchangeability within all ADP installations which use that particular programming language.

The results of running a compiler validation system does not suggest the degree to which the compiler is usable (i.e., capable of data processing applications) but the degree to which individual language elements are usable. This will give an indication of conversion areas which will be necessary in order to utilize a source program from another system supporting the same language specification/standard.

The purpose of a compiler validation system is to test a compiler's acceptance of standard language syntax, and, where unambigous, language semantics. The latter of course is a more difficult area because of the lack of appropriate mechanisms for precise semantic specifications. The compiler validation system does not evaluate the implementation of a compiler nor its quantitative performance characteristics.

3.   THE COBOL COMPILER VALIDATION SYSTEM

There are two COBOL Compiler Validation Systems (CCVS). The first is based on COBOL 68 and the second is based on COBOL 74. Each of the COBOL Compiler Validation Systems consist of audit routines, their related data, and an executive routine (VP-routine) which prepares the audit routines for compilation. Each audit routine is a COBOL program which includes many tests and supporting procedures indicating the result of the tests. The audit routines making up the 1968 COBOL Compiler Validation System collectively contain all the language elements of COBOL 68 (except for the Report Writer module and the ENTER statement of the Nucleus module), as specified in FIPS PUB 21.

The 1974 COBOL Compiler Validation System is being released in increments. Version 1.0 of the 1974 CCVS which was released in November 1975 contains all the language elements included in the low-intermediate level of FIPS PUB 21-1 COBOL (see FIPS PUB 21-1 for information regarding the contents of the various Federal levels of COBOL). Version 2.0 (and subsequent versions) of the 1974 CCVS will contain all elements of FIPS PUB 21-1 except for the ENTER statement of the Nucleus module.

The executive routine creates a file containing the audit routines with implementor names inserted in the source code, and the operating system control cards required for compiling and executing each routine. The testing of a compiler in a particular hardware/operating system environment is accomplished by compiling and executing each audit routine. The output report produced by each routine indicates whether each test passed, failed or had to be deleted.

If the compiler rejects some language element by terminating compilation, giving fatal diagnostic messages, or terminating execution

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abnormally, then the test containing the code the compiler was unable to process is deleted, and the audit routine compiled again. A test is deleted by changing the source code contained in the test paragraph to comments, thereby causing the compiler to ignore that test and indicate on the output report that the test was deleted. If the compiler accepts the language element syntactically the language element is tested semantically and reported as a pass or fail on the output report.

The output reports of the audit routines constitute the raw data from which the members of the Federal COBOL Compiler Testing Service produce a Validation Summary Report (VSR) (see paragraph 6).

A magnetic tape containing the CCVS, and a User Guide, may be obtained by writing to the National Technical Information Service, Springfield, Virginia, 22151. (See paragraph 7.)

4. THE FORTRAN COMPILER VALIDATION SYSTEM

The FORTRAN Compiler Validation System (FCVS), like the COBOL Compiler Validation System, is made up of audit routines, their related data and an executive routine (VP-Routine) which prepares the audit routines for compilation. Each audit routine is a FORTRAN program which contains many tests and supporting procedures indicating the results of the tests. The audit routines for Version 1.0 of the FCVS collectively contain a set of language elements which represent an intersection of FORTRAN 66 (X3.9-1966 American Standard FORTRAN) and the proposed revision to FORTRAN 66 which should be adopted in 1977.

For information regarding the Validation of FORTRAN Compilers, contact:

> Director, Software Development Division
> Department of the Navy
> ADPE Selection Office
> Washington, D. C. 20376

5. OBTAINING VALIDATION SERVICES

Introduction

The NBS-DOD agreement covers cost-reimbursable tests requested by:

- vendors wishing to have a compiler validated for their own purposes;

- vendors wishing to have a compiler validated in response to a Government request for proposals;

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- Government agencies involved in a procurement; or

- Government agencies wishing to validate a compiler already in use.

The computed results produced during a validation will be reviewed by the Federal COBOL Compiler Testing Service, which will prepare a Validation Summary Report (VSR) for initial dissemination to the requestor. If the requested validation has previously been performed on a similar computer configuration, the validation run need not be repeated, and the earlier VSR will be provided to a requestor. The VSR will classify a compiler according to each level of the Federal COBOL Standard which it has met.

Requesting Validation Services

A REQUEST FOR VALIDATION SERVICES form may be obtained by writing to:

> Director
> Federal COBOL Compiler Testing Service
> Department of the Navy
> ADPE Selection Office
> Washington, D. C. 20376

The request form identifies the service required (Validation Summary Report, validation for a compiler not yet tested, FIPS PUB 21 or FIPS PUB 21-1, etc.), and appropriate supporting information, including a point of contact in the requesting agency, compiler and related operating system identification, machine make and model number, and special requirements, if any. If the request is for a validation, a Compiler Validation Manager will be assigned by the FCCTS to process the request. The assigned individual will contact the requesting agency to make the appropriate arrangements, and, if necessary, obtain appropriate documentation.

An estimate of expenses will be provided to the requestor for approval prior to a validation. The approval and, if applicable, an appropriation accounting number should be given as promptly as possible to the FCCTS. Agencies are charged only actual expenses. These will include travel, per diem, and related costs.

Upon completion of the validation, a VSR will be compiled from the raw data and forwarded to the requestor. A copy of the VSR will also be sent to the appropriate vendor and to the National Bureau of Standards.

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Facilities Required

The Testing Service does not have access to its own computing facilities. Thus, we must rely on the requestor to make necessary arrangements in this regard. Also, personnel knowledgeable in the system being validated should be available for assistance, and some office space will generally be required. A validation will usually require a 3-5 day site visit by FCCTS personnel for the actual running of the audit routines. These routines can be executed in conjunction with an installation's normal workload, however in order to expedite the validation process a priority may have to be assigned to jobs related to the running of the compiler validation system to insure responsive turnaround. Preparation of the VSR by the Testing Service will usually take 2-4 weeks, depending on the status of the compiler and on the existing backlog of validation requests.

Follow-up to a Validation

Personnel from the Testing Service are available for follow-up meetings with both requestors and vendors. These meetings afford everyone concerned the opportunity to clear up any questions regarding the validation.

Ambiguities encountered in validation tests which cannot be resolved among the Testing Service, requestor, and vendor, will be referred to a Federal COBOL Interpretation Committee chaired by NBS. This group will be responsible for prompt and consistent resolution of questions involving interpretation of the current Federal Standard. All questions arising from a validation should be directed to the Testing Service.

6. THE VALIDATION SUMMARY REPORT

Preparation of the VSR

The Validation Summary Report (VSR) is prepared by the FCCTS from the raw results derived from the validation of a compiler. This includes all VP-Routine output, all compiler output (abnormal, as well as normal termination) and all audit routine output (abnormal, as well as normal termination).

Use of the VSR

The validity of the subject compiler as determined through the use of the CCVS is reflected in the VSR. Discrepancies described can be categorized by the requestor as to his needs. For example:

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a.   Problems which should be corrected prior to acceptance/
     use of the compiler.

b.   Problems which should be corrected as soon as possible,
     but acceptance/use of the compiler is suggested.

c.   Problems which should be corrected as normal maintenance
     to the compiler.

Organization of the VSR

The Validation Summary Report (VSR) provides a consolidated summary
of the results obtaineed from the validation of a compiler.   The VSR is
made up of several sections showing the discrepancies found.   The
following briefly describes the contents of these sections:

a.   Section 1 is an introduction to the VSR.

b.   Section 2 is an overview of the validation which lists
     all categories of discrepancies by level within each
     module.   The discrepancies are in two groups, based on
     syntax support and semantic support.   Each category of
     discrepancy references the first occurrence of that type
     of error noted in Appendix A.

c.   Section 3 relates the categories of discrepancies in
     Section 2 to each of the Federal levels of the language.
     This permits determination of the status of the com-
     piler against a particular level of the Federal Standard.

d.   Section 4 of FIPS PUB 21 (COBOL 68) Validation Summary
     Reports contain the results of "Information" tests.
     The results of these tests, due to ambiguities in COBOL
     68, are not defined.   Therefore, the results of these
     tests are provided as information about the compiler
     and may be of use to the requestor/reader.

e.   Section 4 for VSRs other than FIPS PUB 21 (COBOL 68)
     and Section 4 for VSRs based on FIPS PUB 21 (COBOL 68)
     is a description of the software environment used for
     the validation.   This includes the Operating System
     and Compiler release/version numbers, parameters used
     in the compiler call statement which could change the
     way in which the compiler interrupts the source program
     and any other information which had to be supplied/
     modified by the validation team during the validation.

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f. Appendix A (which is _not_ part of the Validation Summary
    Report) is a detailed evaluation and contains all dis-
    crepancies noted during the validation. (Note - A
    similar problem may occur in several programs and would
    be mentioned once for each occurrence in Appendix A.
    However, in the body of the VSR in Section 2 it would be
    mentioned once by category and contain a reference to
    the first occurrence in Appendix A.)

Timeliness

The timeliness of the VSR is important, since compilers may change
several times each year. Thus, a validation is generally applicable
only to the compiler version/release, operating system version/release
and pertinent components of the equipment configuration for which it
was performed.

Distribution of the VSR

The Federal COBOL Compiler Testing Service may make full and free
public disclosure of the Validation Summary Report (VSR). The results
of a validation are only for the purpose of satisfying United States
Government requirements, and apply only to the computer system, opera-
ting system release, and compiler version identified in the VSR. It
is not expected that any portion of the information submitted by an
applicant in his Request for Validation or in support thereof, will be
exempt from free and full disclosure to the public in accordance with
the "Freedom of Information Act" (5 U.S.C. #552). If, however, the
applicant believes that any portion of his submission in the support
documentation is exempt from public disclosure, each such portion shall
be identified (by circling, underscoring or by noting) and the reason
for the asserted exemption shall be fully explained. The COBOL Compiler
Validation System is used to determine, insofar as is practical, the
degree to which the subject compiler conforms to the Federal COBOL
Standard. Thus, the VSR is necessarily discretionary and judgmental.
The United States Government does not represent or warrant that the
statements, or any one of them, set forth in the Validation Summary
Report are accurate or complete. The VSR is not meant to be used for
the purpose of publicizing the findings summarized herein.

7. INFORMATION CHANNELS

The Testing Service will periodically issue memoranda, newsletters,
reports, etc., providing information pertinent to COBOL compiler valida-
tion. Anyone wishing to be placed on the mailing list should indicate
by writing to:

Director
                    Federal COBOL Compiler Testing Service
                    Department of the Navy
                    ADPE Selection Office
                    Washington, D. C. 20376
                    (202) 697-1247

The following references are suggested for additional information:

    a. American National Standard COBOL X3.23-1968, American
        National Standards Institute Incorporated, New York, 1968.

    b. American National Standard Programming Language COBOL
        X3.23-1974, American National Standards Institute Incor-
        porated, New York, 1974.

    c. Baird, G. N., The DOD COBOL Compiler Validation System,
        Proc. Fall Joint Computer Conference 1972, 819-827.

    d. Chief of Naval Operations, Information Systems Division
        (OP-91), Navy COBOL Compiler Validation System - User's
        Guide, January 1973.

    e. FIPS PUB 21, COBOL.

    f. FIPS PUB 21-1, COBOL.

    g. FPMR 101-32.1305-1 -- Implementation of FIPS PUB 21-1.

    h. FPMR 101-32.1305-1a -- Validation of COBOL compilers.

    The Compiler Validation Systems currently being supported by the
Navy are being distributed by the National Technical Information Service.
For further information please write to:

                    National Technical Information Service
                    U. S. Department of Commerce
                    Springfield, Virginia 22151
                    (703) 321-8517

U. S. Navy COBOL Compiler Validation System 1968 (CCVS68) Version 6.2

        ADA024913   CCVS Users Guide $ 5.00
        ADA024912   CCVS Population File (TAPE) $500.00

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U. S. Navy COBOL Compiler Validation System 1974 (CCVS74) Version 1.0
(Includes low-intermediate level of Federal Standard COBOL)

ADA017940	CCVS Users Guide	$ 5.00
ADA017941	CCVS Population File (TAPE)	$500.00

U. S. Navy HYPO-COBOL Compiler Validation System (HCVS74) Version 1.0

ADA018916	HYPO-COBOL Language Specifications	$ 6.25
ADA024915	HYPO-COBOL Test Specifications	$ 11.75
ADA024916	HYPO-COBOL Implementation Document	$ 4.00
ADA024914	HYPO-COBOL Population File (TAPE)	$200.00

U. S. Navy FORTRAN Compiler Validation System 1977 (FCVS77) Version 1.0

ADA030209	FCVS Information File (TAPE)	$200.00
ADA030210	FCVS User Guide	$ 6.75
ADA030211	FCVS Test Specifications	$ 13.00

COBOL VALIDATION

Title 41—Public Contracts and Property Management

CHAPTER 101—FEDERAL PROPERTY MANAGEMENT REGULATIONS

SUBCHAPTER E—SUPPLY AND PROCUREMENT

[FPMR Amendment E-174]

PART 101-32—GOVERNMENT-WIDE AUTOMATED DATA MANAGEMENT SERVICES

Validation of Cobol Compilers

In the May 24, 1974, issue of the FEDERAL REGISTER (39 FR 18299), the General Services Administration published a notice of proposed rulemaking adding to Subpart 101-32.13 a new § 101-32.1305-1a, Validation of COBOL compilers. As proposed, GSA would establish policy for testing COBOL compilers and would require Federal agencies to ensure that these compilers are tested to confirm that they meet a designated level of the Federal Standard COBOL. All comments submitted about the proposed amendment were considered. Because this regulation concerns a complex area, it is subject to change with its use. Comments and suggestions for improvement are invited from all interested parties.

The table of contents for Part 101-32 is amended by adding the following new entry:

101-32.1305-1a Validation of COBOL compilers.

SUBPART 101-32.13—IMPLEMENTATION OF FEDERAL INFORMATION PROCESSING STANDARDS PUBLICATIONS (FIPS PUB) INTO SOLICITATION DOCUMENTS

Section 101-32.1305-1a is added to Subpart 101-32.13 as follows:

§ 101-32.1305-1a Validation of COBOL compilers.

This section prescribes the policy for testing COBOL compilers that are asserted to conform with one or more levels specified in the Federal Information Processing Standards Publication (FIPS PUB) 21-1, Federal Standard COBOL, and are offered to the Federal Government for purchase or lease. The term validation as used in the context of this section is the process of testing a given COBOL compiler against predetermined conditions and specifying which, if any, conditions are not met.

NOTE: Although this regulation refers to FIPS PUB 21-1 this regulation applies equally to all compilers based on FIPS PUB 21 brought into the Federal inventory subsequent to the effective date of this regulation and during the transition period described in paragraph 11.2 of FIPS PUB 21-1.

(a) FIPS PUB 21-1 specifies the use of the American National Standard COBOL, X3.23-1974, as the Federal Standard COBOL. This standard defines the elements of the COBOL programming language and the rules for their use. COBOL compilers offered by vendors as a result of requirements set forth by Federal agencies in solicitations must implement the language elements of a designated level of the Federal Standard COBOL. To confirm that an implementation meets the specifications of a designated level of the Federal Standard COBOL, test routines have been developed and approved for use in testing COBOL compilers. These routines are known as the COBOL Compiler Validation System (CCVS). A Federal COBOL Compiler Testing Service (FCCTS) also has been established to provide a validating service for the Federal agencies. The FCCTS is sponsored by the Department of Defense (DOD) under delegation of authority from the National Bureau of Standards (NBS).

(b) All COBOL compilers brought into the Federal inventory shall be validated. The test results for a COBOL compiler shall be used by a Federal agency to confirm that, insofar as the CCVS tests the language elements included in a designated level of Federal Standard COBOL, the compiler meets the specifications of that level of the Standard. When an agency has indicated a waiver to a Federal Standard COBOL specification in a solicitation, only the portions of the language that have been waived are excluded from the validation requirements.

(c) Requests for validations and questions pertaining thereto are submitted to:

Director, Federal COBOL Compiler, Testing Service, Department of the Navy, ADPE Selection Office, Washington, DC 20376.

(d) When a request for validation service requires that compiler testing be performed, the requestor is responsible for providing the necessary test facilities.

(e) In response to a request for validation service, the FCCTS will provide a Validation Summary Report (VSR) reflecting a summarization of the test results.

(f) Validation is performed on a cost-reimbursable basis. The FCCTS will send the requestor an estimate of validation costs, reimbursable to the FCCTS, which is to be approved before beginning the validation process.

(g) Unresolved questions and/or any ambiguities that are identified by the FCCTS or by the requestor shall be referred to the NBS in accordance with FIPS PUB 29.

(h) The standard terminology for use in solicitation documents is:

VALIDATION OF COBOL COMPILERS

In addition to the specified mandatory COBOL compiler requirements stated in the specification portion of this solicitation, all COBOL compilers brought into the Federal inventory as a result of this solicitation, the most recent release of which has not previously been tested, must be tested using the official COBOL Compiler Validation System (CCVS). Validation shall be in accordance with Federal Property Management Regulation (FPMR) 101-32.1305-1a. The results of the validation shall be used to confirm that the compiler meets the specified requirements of the designated level of FIPS PUB 21-1 Federal Standard COBOL. To be considered responsive the vendor shall:

(i) Certify in his proposal that all COBOL compilers offered in response to this solicitation have been submitted for validation as set forth in FPMR 101-32.1305-1a.

(ii) Agree to correct all deviations from the standard reflected in the Validation Summary Report (VSR) not previously covered by a waiver. All deviations must be corrected within 12 months from the date of contract award unless a shorter period is specified elsewhere in this solicitation. If an interpretation of the Standard is required that will invoke the procedures set forth in FIPS PUB 29, such requests for interpretations will be made within 30 calendar days after contract award.

Any corrections that are required as a result of decisions made under the procedures of FIPS PUB 29 will be completed within 12 months of the date of formal notification of the interpretation to the contractor. Failure to make required corrections within the time provisions set forth above shall be deemed a failure to deliver required software. The liquidated damages as specified for failure to deliver either operating system or other software shall apply. In addition, such failure falls within the purview of the default clause. If the required corrections are not made within the time provisions specified above, subsequent proposals submitted to the Government offering the deficient COBOL compilers or subsequent uncorrected versions thereto shall be considered non-responsive.

(Sec. 205(c), 63 Stat. 390; (40 U.S.C. 486(c))

Effective date. This regulation is effective November 14, 1975.

Dated: November 4, 1975.

DWIGHT A. INK,
Acting Administrator of
General Services.

[FR Doc.75-30757 Filed 11-13-75;8:45 am]

Title 41—Public Contracts and Property Management

CHAPTER 101—FEDERAL PROPERTY MANAGEMENT REGULATIONS

[FPMR Amendment E-188]

PART 101-32—GOVERNMENT-WIDE AUTOMATED DATA MANAGEMENT SERVICES

Validation of Cobol Compilers; Substitute to Standard Terminology

FPMR Amendment E-174 (40 FR 53012), requiring the validation of COBOL compilers, was published on November 14, 1975. FPMR Amendment E-174 requires that all COBOL compilers brought into the Federal inventory must be validated to determine their conformance with Federal Information Processing Standard Publication (FIPS PUB) 21-1, Federal Standard COBOL.

Vendors are unable to comply with certain requirements of the new regulation because their development of compilers based on FIPS PUB 21-1 is in various stages of completion. FIPS PUB 21-1 provides for an interim period (December 1, 1975 to June 1, 1977) to allow vendors to make the transition from the FIPS PUB 21 standard.

This regulation provides a substitute paragraph with special terminology for solicitation documents that will be used by agencies during this transition period.

Subpart 101-32.13—Implementation of Federal Information Processing Standards Publications (FIPS PUBS) Into Solicitation Documents

The following note is added after paragraph (h) of § 101-32.1305-1a.

§ 101-32.1305-1a Validation of COBOL compilers.

* * * * *

Note.—The following paragraph shall be used to replace paragraph (h) of this section during the interim period of implementation of Federal Standard COBOL (December 1, 1975 to June 1, 1977). The language below is applicable to FIPS PUB 21-1 only. Provisions of § 101-32.1305-1a fully apply to compilers that are based on FIPS PUB 21, offered as a substitute for FIPS PUB 21-1 compilers during the interim period as prescribed in paragraph 11.2 of FIPS PUB 21-1.

VALIDATION OF COBOL COMPILERS

(FIPS PUB 21-1, substitute for paragraph (h))

In addition to the specified mandatory COBAL compiler requirements stated in the specification portion of this solicitation, all COBOL compilers brought into the Federal inventory as a result of this solicitation, which have not been tested, must be tested using the official COBOL Compiler Validation System (CCVS). Validation shall be in accordance with Federal Property Management Regulation (FPMR) 101-32.1305-1a. The results of the validation shall be used to confirm that the compiler meets the specified requirements of the designated level of FIPS PUB 21-1 Federal Standard COBOL. To be considered responsive the vendor shall:

1. Certify in the proposal that all COBOL compilers offered in response to this solicitation based upon FIPS PUB 21-1 shall be submitted for validation as set forth in FPMR 101-32.1305-1a no later than June 1, 1977.

ii. Agree to correct all deviations from the standard reflected in the Validation Summary Report (VSR) not previously covered by a waiver. Corrections shall be made within 12 months of receipt of the VSR by the contractor or June 1, 1978, whichever is later unless a shorter period is specified elsewhere in this solicitation. If an interpretation of the standard is required that will invoke the procedures set forth in FIPS PUB 29, such requests for interpretation will be made within 30 calendar days after receipt of the VSR by the contractor.

Any corrections that are required as a result of decisions made under the procedures of FIPS PUB 29 will be completed within 12 months of the date of formal notification of the interpretation to the contractor. Failure to make required corrections within the time provisions set forth above shall be deemed a failure to deliver required software. The liquidated damages as specified for failure to deliver either operating systems or other software shall apply. In addition, such failure falls within the purview of the default clause. If the required corrections are not made within the time provisions specified above, subsequent proposals submitted to the Government offering the deficient COBOL compilers or subsequent uncorrected versions thereto shall be considered non-responsive.

(Sec. 205(c), 63 Stat. 390; 40 U.S.C. 486(c))

Effective date: This regulation is effective June 9, 1976.

Dated: June 2, 1976.

JACK ECKERD,
*Administrator of
General Services.*

[FR Doc.76-16703 Filed 6-8-76;8:45 am]

PART 101-32—GOVERNMENT-WIDE AUTOMATED DATA MANAGEMENT SERVICES

Implementation of Federal Information Processing Standards Publication (FIPS PUB) 21-1 Federal Standard COBOL Into Solicitation Documents

FIPS PUB 21 specifies the use of the American National Standard COBOL as the Federal Standard COBOL. FIPS PUB 21-1 revises and supersedes FIPS PUB 21 as the Federal Standard COBOL, reflects major changes and improvements to the COBOL specifications, and defines the elements of the COBOL programing language. The primary purpose of the standard is to promote a high degree of interchangeability of programs for use on a wide variety of information processing systems. All orders for COBOL compilers placed after December 1, 1975, must specify compilers that comply with FIPS PUB 21-1.

1. The table of contents for Part 101-32 is amended by changing the caption of § 101-32.1305-1 to read:

Sec.
101-32.1305-1 FIPS PUB 21-1. Federal Standard COBOL.

2. New § 101-32.1305-1 replaces old §101-32.1305-1 and is added to Subpart 101-32.13 as follows:

§ 101-32.1305-1 FIPS PUB 21-1, Federal Standard COBOL.

(a) FIPS PUB 21-1 specifies the use of the American National Standard CO-BOL X3.23-1974 as the Federal Standard COBOL. FIPS PUB 21-1 revises and supersedes FIPS PUB 21 and reflects major changes and improvements to COBOL specifications. The revision defines the elements of the COBOL programing language and the rules for its use. The primary purpose of the standard is to promote a high degree of interchangeability of programs for use on a wide variety of information processing systems. All COBOL compilers brought into the Federal Government inventory must be validated in accordance with § 101-32.1305-1a. (Technical specifications of the standard are not included with FIPS PUB 21-1.)

(b) The standard terminology for use in solicitation documents is:

ACQUISITION OF COBOL COMPILERS

Federal Standard COBOL compilers offered as a result of the requirements set forth in this solicitation will be identified as implementing all of the language elements of at least one of the levels of Federal Standard COBOL as specified in FIPS PUB 21-1. Implementation must provide a facility for the user to optionally specify a level of Federal Standard COBOL for monitoring the source program at compile time. Monitoring may be specified for any level at or below the highest level for which a compiler is implemented, and will consist of an analysis of the syntax used in a source program against the syntax included in the level specified for monitoring. Any syntax not conforming to the specified level will be identified through a diagnostic message in the source program listing. The diagnostic message will contain at least the identification of the source program line number for each non-conforming syntax and identify the level of Federal Standard COBOL that supports the syntax or that the syntax is non-standard COBOL.

The provisions of the FIPS PUB 21-1 will apply to compilers delivered after December 1, 1975. However, a compiler conforming to FIPS PUB 21 that has been validated in accordance with 41 CFR 101-32.1305-1a may be offered for interim use until a compiler conforming to FIPS PUB 21-1 is available. If this interim approach is used, delivery of the compiler conforming to FIPS PUB 21-1 must be accomplished by June 1, 1977.

ACQUISITION OF COBOL PROGRAMS AND OR PROGRAMING SERVICES

Business-oriented computer application programs (i.e., those applications or programs that emphasize the manipulation of characters, files, and input/output as contrasted with those concerned primarily with computation of numeric values) offered or prepared as a result of the requirements set forth in this solicitation will be written using one of the levels of Federal Standard COBOL as defined in FIPS PUB 21-1 including optional language elements, if any, as specified herein. Programs using Federal Standard COBOL as specified in FIPS PUB 21 are acceptable until June 1, 1977. However, after that date only programs using Federal Standard COBOL as specified in FIPS PUB 21-1 will be acceptable.

(Sec. 205(c), 63 Stat. 390; (40 U.S.C. 486(c)))

Effective date. This regulation is effective April 6, 1976.

Dated: March 24, 1976.

T. M. CHAMBERS,
*Acting Administrator
of General Services.*

[FR Doc.76-9687 Filed 4-5-76,8:45 am]

COBOL

CATEGORY: SOFTWARE STANDARD
SUBCATEGORY: PROGRAMMING LANGUAGE

U. S. DEPARTMENT OF COMMERCE, Rogers C. B. Morton, *Secretary*

James A. Baker, III, *Under Secretary*
Dr. Betsy Ancker-Johnson, *Assistant Secretary for Science and Technology*
NATIONAL BUREAU OF STANDARDS, Ernest Ambler, *Acting Director*

Foreword

The Federal Information Processing Standards Publication Series of the National Bureau of Standards is the official publication relating to standards adopted and promulgated under the provisions of Public Law 89-306, and Part 6 of Title 15 Code of Federal Regulations. The entire series constitutes the FEDERAL INFORMATION PROCESSING STANDARDS REGISTER.

The series is used to announce Federal Information Processing Standards, and to provide standards information of general interest and an index of relevant standards publications and specifications. Publications that announce adoption of standards provide the necessary policy, administrative, and guidance information for effective standards implementation and use. The technical specifications of the standard are usually attached to the publication, otherwise a reference source is cited.

Comments covering Federal Information Processing Standards and Publications are welcomed, and should be addressed to the Associate Director for ADP Standards, Institute for Computer Sciences and Technology, National Bureau of Standards, Washington, D.C. 20234. Such comments will be either considered by NBS or forwarded to the responsible activity as appropriate.

ERNEST AMBLER, *Acting Director*

Abstract

This FIPS PUB announces the adoption of the American National Standard COBOL (X3.23-1974) as the Federal Standard COBOL. This revision supersedes FIPS PUB 21 and reflects major changes and improvements to the COBOL specifications. The American National Standard defines the elements of the COBOL Programming Language and the rules for their use. The standard is used by implementors as the reference authority in developing compilers and by users for writing programs in COBOL. The primary purpose of the standard is to promote a high degree of interchangeability of programs for use on a variety of automatic data processing systems. The COBOL language is intended for use in computer applications that emphasize the manipulation of characters, records, and files.

Key words: COBOL; data processing; Federal Information Processing Standard; information interchange; information processing; programming language; software; standards conformance.

Federal Information
Processing Standards Publication 21-1

1975 December 1

ANNOUNCING THE STANDARD FOR

COBOL

Federal Information Processing Standards Publications are issued by the National Bureau of Standards pursuant to the Federal Property and Administrative Services Act of 1949 as amended, Public Law 89-306 (79 Stat. 1127), as implemented by Executive Order 11717 (38 FR 12315, dated May 11, 1973), and Part 6 of Title 15 CFR (Code of Federal Regulations).

1. Name of Standard. COBOL (FIPS PUB 21-1).

2. Category of Standard. Software Standard, Programming Language.

3. Explanation. This publication announces the adoption of American National Standard COBOL, X3.23-1974, as amplified herein as a Federal Standard. This revision supersedes FIPS PUB 21 and reflects major changes and improvements to the COBOL specifications. The American National Standard defines the elements of the COBOL Programming Language and the rules for their use. The standard is used by implementors as the reference authority in developing compilers and by users for writing programs in COBOL. The primary purpose of the standard is to promote a high degree of interchangeability of programs for use on a wide variety of information processing systems. Other languages, appropriate for applications that are not adequately serviced by COBOL, are being considered for adoption as Federal Standards.

4. Approving Authority. Secretary of Commerce.

5. Maintenance Agency. Department of Commerce, National Bureau of Standards (Institute for Computer Sciences and Technology).

6. Cross Index. American National Standard X3.23-1974, COBOL.

7. Related Documents.

a. Federal Information Processing Standards Publication 29, Interpretation Procedures for Federal Standard COBOL.

b. Federal Property Management Regulation 101-32.1305-1, Implementation of Federal Information Processing Standards Publications (FIPS PUB) into Solicitation Documents, Software Standards.

c. Federal Information Processing Standards Publication 13, Aids for COBOL Program Conversion (FIPS PUB 21 to FIPS PUB 21-1).

8. Objectives. The basic objectives in applying Federal Standard COBOL are: (1) to achieve the long-recognized advantages that are inherent in the use of higher level languages, and (2) to maximize and protect program investments by making it easier and less expensive to exchange programs among different computer systems, including replacement systems.

The attainment of these objectives, from a government-wide point of view, depends upon the widespread use of Federal Standard COBOL. Thus, the general intent of this publication is to provide a standard language that can be used in programming information processing applications except in circumstances, discussed below, where such use would not be advantageous.

9. Applicability. Federal Standard COBOL will be used in programming computer applications and programs that emphasize the manipulation of characters, records, files and input/output (as contrasted with those concerned primarily with computational problem solving) which are developed or acquired for government use. Specifically, the standard will be used for such applications whenever:

—the application is being designed and programmed centrally for a decentralized system that employs computers of different makes, models and configurations

—the program will or might possibly be run on equipment other than that for which the program is initially written

—it is anticipated that the life of the program will be longer than the life of the presently installed equipment

—the application or program is under constant review for updating of the specifications, and changes may result frequently

—the advantages of the use of this higher level language can accrue locally irrespective of interchange potential (e.g., ease of coding, ease of documentation, improved understanding, and ease of debugging).

Exceptions to the use of Federal Standard COBOL may be made when:

a. A comparative analysis shows that the advantages inherent in the use of Federal Standard COBOL are clearly offset by even greater advantages obtainable through use of an alternative language. The language selection should be made in consideration of the government's overall objectives. Such exceptions to the use of Federal Standard COBOL shall be subject to a waiver procedure approved by the head of the agency. The special circumstances identified in paragraphs b through e below are exempted from the requirement for a waiver at the discretion of the head of an agency. See paragraph 12, Waivers.

b. The program requirements are more economically and efficiently satisfied through the use of report generation, data base management, or text processing languages.

c. The program is to be processed on systems for which COBOL compilers are normally not developed. If, however, a COBOL compiler is available on a system other than the target system and the compiler generates object code for the target system (cross-compiler), COBOL should be used to the extent practicable. This exception alone is not to be construed as allowing exemption to the requirement for the use of COBOL on small computer systems, such as mini-computers, where they are being used for applications covered above.

d. The program is to be processed on systems that are in the Federal inventory and for which a standard COBOL compiler is not available.

e. The computer installation is oriented toward the use of scientific and engineering applications in which case incidental information processing applications may be programmed in locally used languages.

Federal agencies should give special attention to ensuring that programs for applications that will or are likely to be used by organizations outside the Federal Government (i.e., State and local governments and others) are written and made available in Federal Standard COBOL, in order to provide maximum interchangeability in their use.

10. Specifications. Federal Standard COBOL specifications are the language specifications contained in American National Standard COBOL, X3.23–1974. For purposes of Federal Standard COBOL, the modules defined in X3.23–1974 are combined into four levels. The four levels of Federal Standard COBOL are identified as: Low, Low-Intermediate, High-Intermediate, and High. Each Federal Standard COBOL level is composed of either the high or low levels of the nucleus and ten of the eleven Functional Processing Modules (FPM's) defined in X3.23–1974. The four Federal Standard COBOL levels are reflected in the following table. The numbers in the table refer to the level within the FPM or nucleus as designated in X3.23–1974, and a dash in the table denotes the corresponding FPM is omitted.

	Low Level	Low Intermediate Level	High Intermediate Level	High Level
Nucleus	1	1	2	2
FPM's				
Table Handling	1	1	2	2
Sequential I–O	1	1	2	2
Relative I–O	—	1	2	2
Indexed I–O	—	—	—	2
Sort-Merge	—	—	1	2
Report Writer	—	—	—	—
Segmentation	—	1	1	2
Library	—	1	1	2
Debug	—	1	2	2
Inter-Program Communication	—	1	2	2
Communication	—	—	2	2

NOTE: The "REPORT WRITER" module is not mandatory in any Federal level. However, the specifications contained in X3.23–1974 should be used to the extent practical, consistent with the requirements.

11. Implementation. Implementation of the Federal Standard COBOL is divided into five areas of consideration: acquisition of COBOL compilers, transition to FIPS PUB 21-1, conformance to Federal Standard COBOL, interpretation of Federal Standard COBOL, and use of COBOL in application programs.

11.1 Acquisition of COBOL Compilers. The provisions reflected in this publication are effective upon the date of this document. All COBOL compilers specified for procurement on or after the effective date must be identified as implementing one of the levels of Federal Standard COBOL. The requirements set forth in this paragraph are applicable to compilers developed in-house, compilers acquired as part of an ADP system procurement, compilers acquired by separate procurement and compilers used under an ADP leasing arrangement.

11.2 Transition to FIPS PUB 21-1. The adoption of American National Standard COBOL, X3.23–1974, as a revised Federal Standard requires that provisions be made for the orderly transition to the revised standard. The transition period will begin on the date of this publication and will continue for eighteen months thereafter. The policies for the acquisition of COBOL compilers during the transition period are:

a. The provisions of FIPS PUB 21 will apply to orders placed before the date of this publication for compilers which are to be delivered subsequent to the date of this publication.

b. The provisions of FIPS PUB 21-1 will apply to orders placed after the date of this publication; however, a compiler conforming to FIPS PUB 21 may be acquired for interim use until the compiler conforming to the revised standard is available. Delivery of the compiler conforming to the revised standard may be deferred to, but not to exceed, the close of the transition period (18 months from the date of this publication).

11.3 Conformance to Federal Standard COBOL. A compiler implemented in conformance to Federal Standard COBOL must satisfy at least the following requirements:

a. The implementation must include *all* of the language elements of at least one of the levels of Federal Standard COBOL.

b. The implementation must satisfy all of the requirements, defined in American National Standard COBOL, X3.23–1974, section I, paragraph 1.5, Definition of an Implementation of American National Standard COBOL. Any requirement stated herein that may differ from the requirements for an implementation of American National Standard COBOL takes precedence over the requirements stated in X3.23–1974.

c. The implementation must provide a facility for the user to optionally specify a level of Federal Standard COBOL for monitoring his source program at compile time. The monitoring may be specified for any level of Federal Standard COBOL at or below the highest level

for which the compiler is implemented. The monitoring will be an analysis of the syntax used in a source program against the syntax included in the specified level of Federal Standard COBOL. Any syntax used in the source program that does not conform to that allowed by the user selected level of Federal Standard COBOL will be diagnosed. The syntax diagnosed as not conforming to the specified level will be identified to the user through a diagnostic message on the source program listing. The diagnostic message will contain at least: (1) the identification of the source program line number in which the non-conforming syntax occurs, and (2) the identification of the level of Federal Standard COBOL that supports the syntax or that the syntax is non-standard COBOL.

In order to confirm that an implementation satisfies the requirements of a designated level of Federal Standard COBOL, programs (which include the Report Writer module) have been developed for testing COBOL compilers. A Federal COBOL Compiler Testing Service (FCCTS) also is available to provide testing services. Policies concerning required testing of COBOL compilers are currently being developed and will be published in the near future by the General Services Administration as an appropriate modification to FPMR 101-32.1305. For further information regarding COBOL Compiler Testing Services contact:

> Director, Federal COBOL Compiler
>   Testing Service
> Department of the Navy
> ADPE Selection Office
> Washington, D.C. 20376

11.4 Interpretation of Federal Standard COBOL. During the use of Federal Standard COBOL, whether implementing compilers, testing compilers or writing source programs, questions may arise from time to time as to the meaning of specific language specifications. It is desirable when this happens to apply a solution to these questions that can be used uniformly throughout the Federal Government and by all implementors of Federal Standard COBOL and the Report Writer module. To achieve this objective, a Federal COBOL Interpretations Committee has been organized. Procedures for processing interpretation of Federal Standard

COBOL are provided in FIPS PUB 29 (paragraph 7a). For further information contact:

> Chairman, Federal COBOL Interpretations Committee
> Computer Science Section
> Systems and Software Division
> Institute for Computer Sciences and
>   Technology
> National Bureau of Standards
> Washington, D.C. 20234

11.5 Use of COBOL. Federal Standard COBOL will be used as defined in paragraph 9, Applicability, as soon as compilers that conform to the standard are available and acquired. It is not intended that existing programs be rewritten solely for the purpose of conforming to the standard.

Programs should, to the extent practicable, be limited to the elements of one of the specified levels of Federal Standard COBOL. It should be recognized that the use of any non-standard language elements may compromise interchangeability of programs between various systems or may complicate future conversion to a replacement system. Extensions should, therefore, be employed only when their use will result in efficiencies that clearly outweigh the difficulties they may cause. To the extent that specifications for the required extensions have already been included in the CODASYL COBOL Journal of Development, use of these specifications should minimize future conversion difficulties.

12. Waivers.

12.1 Policy. Heads of agencies are permitted to waive the requirements stated in this publication in the following circumstances. Each waiver will cover only the specific requirements of this publication related to the need for a waiver.

a. A waiver may be granted for an exception to any of the requirements stated in this publication provided it can be clearly demonstrated that there are appreciable and continuing performance or cost advantages to be gained or that the extenuating circumstances are such that the overall interests of the Federal Government are served by granting the requested waiver.

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b. Special capabilities may be required to accommodate the needs of a particular application that cannot be achieved through the use of Federal Standard COBOL. A waiver must be obtained before these special capabilities are specified for implementation or acquisition. Requests for waiver must clearly demonstrate an appreciable and continuing performance or cost advantage will be obtained through the use of these special capabilities.

12.2 Reporting. Waivers granted in the acquisition of compilers will be reported to the National Bureau of Standards, with the following supporting documentation, within seven working days after approval by the head of the agency.

a. Relevant documentation considered by the head of the agency in authorizing the waiver.

b. Detailed technical specifications of the language deviations granted. In the case of deletions, exact reference to the items in X3.23–1974 is all that is required. In case of additions that are already developed and approved by CODASYL, exact reference to the items in the CODASYL COBOL Journal of Development is all that is required.

c. A recommendation for action by NBS concerning future development of COBOL, relative to the waiver, should be included, as appropriate. Correspondence should be addressed to the Associate Director for ADP Standards, Institute for Computer Sciences and Technology, National Bureau of Standards, Washington, D.C. 20234.

13. Special Information.

a. Development and maintenance of the COBOL language are the responsibilities of the Programming Languages Committee of the Conference on Data Systems Languages (CODASYL), a voluntary organization comprised of interested organizations. Standardization of COBOL in the United States is in the purview of the American National Standards Institute (ANSI), X3J4 Committee. The technical specifications of American National Standard COBOL, herein adopted as a Federal Standard, are based on the specifications contained in CODASYL COBOL Journal of Development,

1973, and changes that were made to the JOD in response to X3J4 requests. The COBOL language is under continual review by the CODASYL organization for modification and extension. These changes are then reviewed by ANSI for incorporation in revised editions of ANS COBOL.

b. In the event that there is no prospect for the development of a COBOL compiler conforming to this standard for the machine used, serious consideration should be given to using the existing COBOL compiler, if available, for new or revised applications to ease the eventual conversion to a new system employing a standard COBOL compiler.

14. Where To Obtain Copies of COBOL Publications.

a. Federal Government activities should obtain copies of this publication from established sources within each agency. When there is no established source, purchase orders should be submitted to the National Bureau of Standards, Institute for Computer Sciences and Technology, Office of ADP Standards Management, Technology Building, Washington, D.C. 20234. Refer to Federal Information Processing Standard Publication 21–1 (FIPS PUB 21–1). Copies of the American National Standard COBOL, X3.23–1974, accompany each copy of FIPS PUB 21–1.

b. Others may obtain copies of the FIPS PUB from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (SD Catalog Number C13.52:21–1). There is a 25 percent discount on quantities of 100 or more. When ordering, specify document number, title, and SD Catalog Number. Payment may be made by check, money order, coupons, or deposit account. Copies of the ANSI standard may be obtained from the American National Standards Institute, Inc., 1430 Broadway, New York, New York 10018. Refer to American National Standard X3.23–1974, Standard Programming Language COBOL.

c. Copies of the CODASYL COBOL Journal of Development may be obtained from the Technical Services Branch, Department of Supply and Services, 5th Floor, 88 Metcalfe Street, Ottawa, Ontario, Canada K1A OS5.

FIPS PUB 21

COMMON BUSINESS ORIENTED LANGUAGE COBOL

CATEGORY: SOFTWARE STANDARD

SUBCATEGORY: PROGRAMMING LANGUAGE

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Foreword

The Federal Information Processing Standards Publication Series of the National Bureau of Standards is the official publication relating to standards adopted and promulgated under the provisions of Public Law 89-306, and under Office of Management and Budget Circular A-86. The entire series constitutes the FEDERAL INFORMATION PROCESSING STANDARDS REGISTER.

This series is used to announce Federal Information Processing Standards, and to provide standards information of general interest and an index of relevant standards publications and specifications. Publications that announce adoption of standards provide the necessary policy, administrative, and guidance information for effective standards implementation and use. The technical specifications of the standard are usually attached to the publication, otherwise a source of copies is cited.

Comments covering Federal Information Processing Standards and Publications are welcomed, and should be addressed to the National Bureau of Standards, Center for Computer Sciences and Technology, Office of Information Processing Standards, Washington, D.C. 20234. Such comments will be either considered by NBS or forwarded to the responsible activity as appropriate.

LEWIS M. BRANSCOMB, *Director*

Abstract

This FIPS PUB announces the adoption of the American National Standard COBOL (X3.23-1968) as the Federal Standard COBOL. The American National Standard defines the elements of the COBOL Programming Language and the rules for their use. The standard is used by implementors as the reference authority in developing compilers and by users for writing programs in COBOL. A primary purpose of the standard is to promote a high degree of interchangeability of programs for use on a variety of automatic data processing systems.

The COBOL language is intended for use with business-oriented applications.

Key words: COBOL; data processing; Federal Information Processing Standard; information interchange; information processing; programming language; software.

**Federal Information
Processing Standards Publication 21**

1972 March 15

ANNOUNCING THE STANDARD FOR

COMMON BUSINESS ORIENTED LANGUAGE (COBOL)

Federal Information Processing Standards Publications are issued by the National Bureau of Standards under the direction of the Office of Management and Budget (OMB) in accordance with the provisions of Public Law 89-306 and OMB Circular No. A-86.

Name of Standard. Common Business Oriented Language (COBOL), (FIPS 21).

Category of Standard. Software Standard, Programming Language.

Explanation. This FIPS PUB announces the adoption of the American National Standard COBOL (X3.23-1968) as the Federal Standard COBOL. The American National Standard (ANS) defines the elements of the COBOL Programming Language and the rules for their use. The standard is used by implementors as the reference authority in developing compilers and by users for writing programs in COBOL. A primary purpose of the standard is to promote a high degree of interchangeability of programs for use on a variety of automatic data processing systems.

The COBOL language is intended to be used with business-oriented applications. Other languages, appropriate to other application areas, are being considered for future adoption as Federal Standards.

Approving Authority. Office of Management and Budget.

Maintenance Agency. Department of Commerce, National Bureau of Standards (Center for Computer Sciences and Technology).

Cross Index. American National Standard X3.23-1968, COBOL.

Objectives. The basic objectives in applying the Federal Standard COBOL Language are

(1) to achieve the long-recognized advantages that are inherent in the use of higher level languages, and (2) to maximize and protect program investments by making it easier and less expensive to exchange programs among different computer systems, including replacement systems.

The attainment of these objectives, from a Government-wide point of view, depends upon the widespread use of Federal Standard COBOL. Thus, the general intent of this FIPS PUB is to provide for the use of this language in programming all business-oriented applications except in circumstances, discussed below, where such use would not be advantageous.

Applicability. Federal Standard COBOL will be used in programming business-oriented computer applications (i.e., those applications or programs that emphasize the manipulation of characters, files and input/output as contrasted with those concerned primarily with the computation of numeric values) which are developed or acquired for Government use at Government expense. Specifically, the standard will be used for such applications whenever

— the application is being designed and programmed centrally for a decentralized system that employs computers of different makes, models, and configurations.

— the program will or might possibly be run on equipment other than that for which the program is initially written.

—it is anticipated that the life of the program will be longer than the life of the presently installed equipment.

—the application or program is under constant review for updating of the specifications and changes may result frequently.

—the advantages of the use of this higher level language can accrue locally irrespective of interchange potential (e.g. ease of coding, ease of documentation, improved understanding, and ease of debugging).

Exceptions to the use of Federal Standard COBOL may be made, however, when any of the following circumstances exist:

1. If a comparative analysis shows that the advantages inherent in the use of Standard COBOL are clearly offset by even greater advantages obtainable through use of an alternative language. The language selection should be made in consideration of the Government's overall objectives and should be approved by a central authority in the agency under a waiver procedure, except for the selection of the special kinds of languages identified in paragraph 2 below.

2. If the use of report generators, file management languages, and text processing languages are clearly more economical and efficient. Decisions to utilize these languages do not necessarily require an agency waiver but must be made with consideration of the Government-wide objectives stated above.

3. If the program is to be processed on equipment systems of small capacity for which COBOL compilers are normally not developed.

4. If the program is to be processed on equipment systems that are in the Federal Inventory and for which a standard COBOL compiler is not available.

5. If the computer installation is heavily oriented toward the use of scientific and engineering applications in which case incidental business-oriented applications may be programmed in locally used languages.

Federal agencies should give special attention to insuring that programs for business-oriented applications that will or are likely to be used by organizations outside the Federal Government (i.e., State and local governments and others) are written and made available in Federal Standard COBOL, in order to provide maximum interchangeability in their use.

Specifications. Federal Standard COBOL consists of four alternative combinations of the modules specified by the American National Standard COBOL (X3.23-1968). These combinations are known as Low, Low-Intermediate, High-Intermediate and High Level *Federal Standard COBOL, respectively. Each* level is defined as consisting of the high or low level nucleus and selected levels of six of the seven Functional Processing Modules (FPMs) of the American National Standard COBOL as follows:

	Low Level	Low-Inter-mediate Level	High-Inter-mediate Level	High Level
Nucleus	Low (1)	High (2)	High (2)	High (2)
FPM				
Table Handling	Low (3)	Intermediate (4)	Intermediate (4)	High (5)
Sequential Access	Low (6)	High (7)	High (7)	High (7)
Random Access	—	High (9)	High (9)	High (9)
Sort	—	—	Low (10)	High (11)
Segmentation	—	Low (14)	Low (14)	High (15)
Library	—	Low (16)	Low (16)	High (17)

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The numbers in parentheses in the above table refer to chapters in X3.23-1968, and a dash in the table denotes that the corresponding FPM is to be omitted.

Implementation. Implementation considerations are divided into acquisition of COBOL compilers and use of COBOL in applications programs.

a. **Acquisition of COBOL Compilers.** Beginning July 1, 1972, all COBOL compilers brought into the Federal Inventory must be identified as implementing one of the levels of the Federal Standard COBOL (See *Specifications* above). This applies to compilers developed in-house, compilers acquired as part of an ADP system procurement and compilers acquired by separate procurement. This does not apply to orders placed before the date of this FIPS PUB for compilers to be delivered subsequent to the implementation date. Each compiler must include *all* of the language elements of the identified level, except that a compiler acquired exclusively to produce object programs for computers without random access devices need not include the random access module regardless of level.

A compiler may include language elements over and above those of the requested level (whether or not they are part of the Federal COBOL Standard) but such additions will not be specified for development or acquisition unless an agency waiver is first obtained. Waivers authorizing such compilers must stipulate that the additional elements, when used, will be automatically identified and flagged (annotated) on the source program listing by the compiling system (i.e., compiler or preprocessor). It is expected that waivers of this nature will be granted only upon a clear demonstration that an appreciable and continuing performance vs. cost advantage, when considered from a Government-wide point of view, would be obtained by the use of such a compiler.

At the present time, agencies acquiring COBOL compilers have the responsibility for insuring vendor compliance with Federal Standard COBOL levels. It is expected that a centralized validation service will soon be available to assist agencies in the area of COBOL compilers. Pending final resolution of this service, agencies should contact the National Bureau of Standards, Office of Information Processing Standards, if assistance is desired.

b. **Use of COBOL.** Federal Standard COBOL will be used for new applications and applications undergoing major revisions, as soon as compilers that conform to the standard specifications are available and acquired. It is not intended that existing programs be rewritten solely for the purpose of conforming to the standard. This includes programs designed for compilers ordered prior to the implementation date of this FIPS PUB for delivery subsequent to that date.

Programs written in standard COBOL should, to the extent practicable, be limited to the elements of one of the specified levels. Although the use of flagged unilateral extensions in applications programs is permitted, it should be recognized that this practice will compromise interchangeability or may complicate future conversion to replacement computers. Extensions should be employed, therefore, only when their use will result in efficiencies that clearly outweigh the difficulties that they may cause.

Waivers. Agencies are permitted to waive the requirements of this FIPS PUB regarding the use of the Federal Standard COBOL and compliance with the COBOL compiler specifications upon proper internal justification. These waivers need not be coordinated in advance with NBS. However, in order that NBS may be knowledgeable about the extent to which agencies find it necessary to deviate from the specifications of this standard in meeting their operational requirements, agencies are requested to provide NBS with the following information on each of the waivers:

a. Waivers granted in the acquisition of compilers will be reported to the National Bureau of Standards with the following information:

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1. Relevant documentation considered by the head of the agency (or his assignee) in authorizing the waiver.
2. Detailed technical specifications of the language deviations granted. In the case of deletions (except as noted under "Implementation 'a'"), exact reference to the items in ANS X3.23 is all that is required.
3. Related to the waiver, a statement of any recommended action that NBS should take concerning future development of COBOL.

b. Waivers involving the *use* of languages other than Federal Standard COBOL, need not be furnished to the National Bureau of Standards. It is requested, however, that the National Bureau of Standards be informed of each occurrence of a major deviation in the use of Federal Standard COBOL in new source programs together with the reasons therefor.

c. Letters should be addressed to the Associate Director for ADP Standards, Center for Computer Sciences and Technology, National Bureau of Standards, Washington, D.C. 20234.

Special Information.

a. Development and maintenance of the COBOL language is the responsibility of the Conference on Data Systems Languages (CODASYL), a voluntary organization comprised of interested organizations. Standardization of COBOL in the United States is in the purview of the American National Standards Institute (ANSI). The technical specifications of American National Standard COBOL, herein adopted as a Federal Standard, are based on the specifications contained in CODASYL COBOL, Edition 1965, as modified by CODASYL through January 1, 1967. The COBOL language is under continual review by the CODASYL organization for

modification and extension. These changes are then reviewed by ANSI for incorporation in revised editions of ANS COBOL.

b. A serious problem that has confronted Federal data processing managers is the often difficult conversion of programs when replacing or upgrading installed computers. Since this involves, in a sense, interchange of programs between computers, then the advantages of using a higher level language apply, even if all that is available is a COBOL compiler that pre-dates the standard. Therefore, in the event such a nonstandard compiler is available, and there are no prospects for the development of a standard COBOL compiler for the machine being used (because it is out of production), serious consideration should be given to the advantages of using the existing (nonstandard) COBOL language for new or revised applications to ease the eventual conversion to a new system employing a standard COBOL compiler.

Where to Obtain Copies of the Specifications of the Standard.

a. Federal Government activities should obtain copies from established sources within each agency. When there is no established source, purchase orders should be submitted to the General Services Administration, Specifications Activity, Printed Materials Supply Division, Building 197, Washington Navy Yard Annex, Washington, D.C. 20407. Refer to Federal Information Processing Standard Number 21 (FIPS PUB 21). Price, $3.05 a copy (includes FIPS PUB).

b. Others may obtain copies from the American National Standards Institute, Inc., 1430 Broadway, New York, New York 10018. Refer to American National Standard X3.23-1968, Standard for Common Business Oriented Language (COBOL). (Price, $6.50 a copy. Discounts available on quantity orders. See ANSI Catalog.)

NBS TECHNICAL PUBLICATIONS

PERIODICALS

JOURNAL OF RESEARCH reports National Bureau of Standards research and development in physics, mathematics, chemistry, and engineering. Comprehensive scientific papers give complete details of the work, including laboratory data, experimental procedures, and theoretical and mathematical analyses. Illustrated with photographs, drawings, and charts.

Published in three sections, available separately:

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Papers of interest primarily to scientists working in these fields. This section covers a broad range of physical and chemical research, with major emphasis on standards of physical measurement, fundamental constants, and properties of matter. Issued six times a year. Annual subscription: Domestic, $9.50; $2.25 additional for foreign mailing.

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● Engineering and Instrumentation

Reporting results of interest chiefly to the engineer and the applied scientist. This section includes many of the new developments in instrumentation resulting from the Bureau's work in physical measurement, data processing, and development of test methods. It will also cover some of the work in acoustics, applied mechanics, building research, and cryogenic engineering. Issued quarterly. Annual subscription: Domestic, $5.00; $1.25 additional for foreign mailing.

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NONPERIODICALS

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Building Science Series. Research results, test methods, and performance criteria of building materials, components, systems, and structures.

Handbooks. Recommended codes of engineering and industrial practice (including safety codes) developed in cooperation with interested industries, professional organizations, and regulatory bodies.

Special Publications. Proceedings of NBS conferences, bibliographies, annual reports, wall charts, pamphlets, etc.

Monographs. Major contributions to the technical literature on various subjects related to the Bureau's scientific and technical activities.

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Technical Notes. This series consists of communications and reports (covering both other agency and NBS-sponsored work) of limited or transitory interest.

Federal Information Processing Standards Publications. This series is the official publication within the Federal Government for information on standards adopted and promulgated under the Public Law 89–306, and Bureau of the Budget Circular A–86 entitled, Standardization of Data Elements and Codes in Data Systems.

Consumer Information Series. Practical information, based on NBS research and experience, covering areas of interest to the consumer. Easily understandable language and illustrations provide useful background knowledge for shopping in today's technological marketplace.

NBS Special Publication 305, Supplement 1, Publications of the NBS, 1968-1969. When ordering, include Catalog No. C13.10:305. Price $4.50; $1.25 additional for foreign mailing.

Order NBS publications from: Superintendent of Documents
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**If you're looking for a solution to
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REQUEST FOR VALIDATION SERVICES

Date of Request:_____

FCCTS Control No.:_____

1. REQUESTOR
   Name_____
   Address_____
   _____

2. POINT OF CONTACT
   Name_____
   Address_____
   _____Telephone_(___)_____

3. REQUEST IS FOR:

   / / Validation Summary Report (if on file)
   / / Validation and Summary Report
       Desired Report Submittal Date_____

4. VERSION OF FEDERAL COBOL REQUIRED

   / / FIPS PUB 21 (X3.23-1968)
   / / FIPS PUB 21-1 (X3.23-1974)

5. LEVEL OF FEDERAL COBOL REQUIRED (1, 2, 3, 4)_____

6. TEST ENVIRONMENT

   a. Hardware

      Machine Make and Model No._____
      Special CPU Requirements_____
      Special Peripheral Requirements_____
      Hardware Manufacturer_____

   b. Software

      Operating System_____
      Operating System Producer_____
      Compiler Documentation (Ref. Manual, etc.)_____
      Compiler Release & Version_____
      Compiler Producer_____

      Personnel to be in Attendance for Validation
         Name_____Location_____
         _____Telephone No._____

7. WHERE VALIDATION WILL TAKE PLACE_____

(See reverse side for instructions.)

23 February 1977

1. Please type or print.
2. Submit the completed form to:

        Director, Federal COBOL Compiler Testing Service
        Department of the Navy
        Washington, D. C. 20376

3. If a Validation Summary Report (VSR) on the subject compiler has already been completed, we will send you information on how to obtain a copy. If not, and a validation has been requested, a Compiler Validation Manager will be assigned to process your request. The assigned individual will contact you to make the necessary arrangements, and, if necessary, obtain the documentation referenced in item 6 of this request.

4. An estimate of expenses will be made and sent to you for approval. The approval and, if applicable, an appropriation accounting number should be given as promptly as possible. You will be charged only for actual expenses. These will include travel, per diem, and pro-rated salaries as appropriate.

5. Upon completion of the validation, a VSR will be compiled from the raw data and forwarded to you. A copy of the VSR will also be sent to the appropriate vendor (if other than yourself) and to the National Bureau of Standards.

6. Should there be any questions as to the FCCTS interpretation of the Federal COBOL Standard, please contact this office within two (2) weeks of receipt of the VSR.

7. PLEASE NOTE: The Federal COBOL Compiler Testing Service may make full and free public disclosure of the Validation Summary Report (VSR). The results of this validation are only for the purpose of satisfying United States Government requirements, and apply only to the Computer System, Operating System release, and compiler version identified in the VSR. It is not expected that any portion of the information submitted by an applicant in his Request for Validation or in support thereof will be exempt from free and full disclosure to the public in accordance with the "Freedom of Information Act" (5 U.S.C. #552). If, however, the applicant believes that any portion of his submission in the support documentation is exempt from public disclosure, each such portion shall be identified (by circling, underscoring or by note) and the reason for the asserted exemption shall be fully explained. The COBOL Compiler Validation System is used to determine, insofar as is practical, the degree to which the subject compiler conforms to the Federal COBOL Standard. Thus, the VSR is necessarily discretionary and judgmental. The United States Government does not represent or warrant that the statements, or any one of them, set forth in the Validation Summary Report are accurate or complete. The VSR is not meant to be used for the purpose of publicizing the findings summarized therein.

8. Our telephone number is (202) 697-1247. Please call us if you require any assistance.

REQUEST FOR VALIDATION SERVICES

Date of Request:_____

SDD Control No.:_____

1. REQUESTOR
   Name_____
   Address_____
   _____

2. POINT OF CONTACT
   Name_____
   Address_____
   _____Telephone (   )_____

3. REQUEST IS FOR:

   / / Validation Summary Report (if on file)
   / / Validation and Summary Report
       Desired Report Submittal Date_____

4. SOFTWARE PRODUCT TO BE VALIDATED

   / / FORTRAN 66 (X3.9-1966)
   / / HYPO-COBOL
   / / OTHER_____

5. TEST ENVIRONMENT

   a. Hardware

      Machine Make and Model No._____
      Special CPU Requirements_____
      Special Peripheral Requirements_____
      Hardware Manufacturer_____

   b. Software

      Operating System_____
      Operating System Producer_____
      Software/Compiler Docu. (Ref. Manual, etc.)_____
      Software/Compiler Release & Version_____
      Software/Compiler Producer_____

      Personnel to be in Attendance for Validation
        Name_____Location_____
        _____Telephone No._____

6. WHERE VALIDATION WILL TAKE PLACE_____

(See reverse side for instructions.)

INSTRUCTIONS/INFORMATION

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2. Submit the completed form to:

   Director, Federal COBOL Compiler Testing Service
   Department of the Navy
   Washington, D. C. 20376

3. If a Validation Summary Report (VSR) on the subject compiler has already been completed, we will send you information on how to obtain a copy. If not, and a validation has been requested, a Compiler Validation Manager will be assigned to process your request. The assigned individual will contact you to make the necessary arrangements, and, if necessary, obtain the documentation referenced in item 6 of this request.

4. An estimate of expenses will be made and sent to you for approval. The approval, and if applicable, an appropriation accounting number should be given as promptly as possible. You will be charged only for actual expenses. These will include travel, per diem, and pro-rated salaries as appropriate.

5. Upon completion of the validation, a VSR will be compiled from the raw data and forwarded to you. A copy of the VSR will also be sent to the appropriate vendor (if other than yourself) and to the National Bureau of Standards.

6. Should there be any questions as to the FCCTS interpretation, please contact this office within two (2) weeks of receipt of the VSR.

7. PLEASE NOTE: The Federal COBOL Compiler Testing Service may make full and free public disclosure of the Validation Summary Report (VSR). The results of this validation are only for the purpose of satisfying United States Government requirements, and apply only to the Computer System, Operating System release, and compiler version identified in the VSR. It is not expected that any portion of the information submitted by an applicant in his Request for Validation or in support thereof will be exempt from free and full disclosure to the public in accordance with the "Freedom of Information Act" (5 U.S.C. #552). If, however, the applicant believes that any portion of his submission in the support documentation is exempt from public disclosure, each such portion shall be identified (by circling, underscoring or by note) and the reason for the asserted exemption shall be fully explained. The United States Government does not represent or warrant that the statements, or any one of them, set forth in the Validation Summary Report are accurate or complete. The VSR is not meant to be used for the purpose of publicizing the findings summarized therein.

8. Out telephone number is (202) 697-1247. Please call us if you require any assistance.

FCCTS - NTIS INFORMATION

ADDRESS: National Technical Information Service
          U. S. Department of Commerce
          5285 Port Royal Road
          Springfield, Virginia 22161
          (703) 557-4650

BENCHMARK PORTABILITY SYSTEM:

AD785356	BPS USERS GUIDE	$ 4.00	*
AD785590	BPS Population File (TAPE)	$ 97.50	

SYNTHETIC PROGRAMS LIBRARY:

AD785357	SPL MANUAL	$ 3.75	*
AD785355	SPL Population File (TAPE)	$ 97.50	

COBOL COMPILER VALIDATION SYSTEM 68 (X3.23-1968, FIPS PUB 21) VERSION 6.?

ADA024913	CCVS USERS GUIDE	$ 5.00	*
ADA024912	CCVS Population File (TAPE)	$500.00	**

COBOL COMPILER VALIDATION SYSTEM 74 (X3.23-1974, FIPS PUB 21-1) VERSION 2.0

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HYPO-COBOL COMPILER VALIDATION SYSTEM

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ADA024915	HCCVS Test Specifications	$ 11.75	*
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ADA024914	HCCVS Population File (TAPE)	$200.00	****

FORTRAN COMPILER VALIDATION SYSTEM

ADA030209	FCVS Information File (TAPE)	$200.00	****
ADA030210	FCVS User Guide	$ 6.75	$ 6.75
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*Micro-fiche will be $2.25 unless otherwise specified.
**Price listed for domestic price; foreign price is $625.00.
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1974 CCVS TEST SPECIFICATIONS (X3.23-1974, FIPS PUB 21-1):

ADA002792	USN-CCVS-74-VOL-01	NUCLEUS Level 1	$ 15.25	*
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ADA002975	USN-CCVS-74-VOL-12	INTER-PROGRAM COMM.	$ 3.75	*
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AD786570	73-01	IBM 370/155	V2 OS	$ 6.50	*
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AD786573	73-10	IBM 360/65	V2.1 OS	$ 6.25	*
AD786090	73-11	HIS OS2000	V2.1	$ 4.25	*
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ADA016923	75-01	HIS 6080	COBOL 2.0/H-FIS*23	$ 3.75	*
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ADA015197	CCVS68-VSR125	UNIVAC 1100	ANSI/ASCII V2.4H	$ 4.00	*
ADA023270	CCVS68-VSR130	DECSystem 10	Version 10	$ 4.60	*
ADA025889	CCVS68-VSR145	UNIVAC 1100	ANSI/ASCII V3R1	$ 4.00	*
ADA023663	CCVS68-VSR140	HIS 6080	STD-68 3/I E	$ 4.00	*
ADA024080	CCVS68-VSR135	IBM 370/168	VS COBOL V1 F1.1	$ 4.00	*
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ADA035518	CCVS68-VSR170	BURR 6700/7700	MCP II.9	$ 4.00	*
ADA037804	CCVS68-VSR135	UNIVAC 70/45	USACOR V011	$ 4.00	*

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ADA020551	CCVS74-VSR115	Interdata 7/16	Release 1.15	$ 4.00	*
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